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October 29, 2015

Ms. Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: IB Docket No. 13-213, Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks: Response to Globalstar's September 10, 2015 *Ex Parte* Notice

Dear Ms. Dortch:

Microsoft Corporation ("Microsoft") writes to respond to Globalstar's September 10, 2015 *ex parte* notice to the Commission regarding its report on a recent demonstration of its proposed Terrestrial Low Power Service ("TLPS") at the student center of a college campus in Chicago, Illinois, conducted by Roberson and Associates, LLP. Globalstar's proposal could endanger full use of Bluetooth, Wi-Fi, and other wireless applications and devices that U.S. consumers rely heavily on. The FCC needs to develop a complete picture of the potential harm and determine what mitigation measures, if any, are possible. Globalstar once again chose to conduct another managed demonstration, which is not a satisfactory substitute for rigorous peer-reviewable testing.

Microsoft believes Globalstar's broad claim that this demonstration shows *"that there are no interference or compatibility issues between TLPS and Wi-Fi, nor with TLPS and Bluetooth operations in the 2.4 GHz ISM band"*[1] overstates the results to the point of being misleading. In sum, the use of enterprise-grade access points and the critical lack of operational parameters provided, combined with the brevity of the compatibility demonstrations makes this latest exhibition of extremely limited use in determining whether channel 14 Wi-Fi operations can be compatible with channel 11 Wi-Fi operations and Bluetooth devices across the installed base of user equipment. For these reasons, Microsoft respectfully requests the Commission look skeptically at Globalstar's latest claim of "no interference" when assessing terrestrial use of the 2473-2495 MHz band for low-power mobile broadband networks.

I. Enterprise Grade Access Points Are Not Representative of the Installed Base of Wi-Fi Access Points And Wi-Fi Equipment

Similar to its previous demonstration at the FCC Technology Experience Center ("FCC TEC"), Globalstar's student center demonstration used an enterprise-grade Ruckus model 7982 intended for indoor use to generate the Channel 14 Wi-Fi signal.[2] The campus wireless network and Wi-Fi access points operating on Channel 1, 6, and 11 were manufactured by Meru Networks. In the absence of any

[1] Globalstar *Ex Parte Notice*, *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks,* IB Docket No. 13-213, Sept. 10, 2015 [hereinafter Globalstar *Ex Parte*].
[2] *See* Ruckus, *ZoneFlex 7982 indoor 802.11n access point*, http://www.ruckuswireless.com/products/access-points/zoneflex-indoor/zoneflex-7982 (last viewed Oct. 4. 2015).

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other information, Microsoft presumes the wireless LAN was a Meru-Education Grade (MEG) system. Based on the company website's description[3], MEG is an enterprise-grade system. An important performance improvement of an enterprise-grade Wi-Fi access point, as compared to a commercial-grade Wi-Fi access point, is improved filtering of the transmitted and received Wi-Fi signal. Likewise, the higher price of an enterprise-grade access point above that of a commercial-grade access point reflects these improvements. And so it is not surprising that enterprise-grade access points make up a very small percentage of the installed base of 2.4 GHz band ISM access points as well as those being sold today. The vast majority of access points in use today and in the future are or will be commercial-grade. In sum, Microsoft does not believe that Globalstar's demonstrations at the student center using all enterprise-grade access points is representative of the vast majority of 2.4 GHz Wi-Fi equipment in operation today.

II. Globalstar's Filing Lacks Information on the Operational Parameters Used During the Compatibility Demonstrations

The lack of basic operational parameters in Globalstar's filing also underscores why the filing should be accorded little weight. For example, in Globalstar's filing, Microsoft could not find reference to the power levels for the access points operating on Wi-Fi Channels 1, 6, and 11, nor for TLPS operations on Channel 14 used for the compatibility demonstrations. The Commission proposed that the total transmit power for TLPS not exceed 1W with a peak EIRP of no more than 6 dBW (4W).[4] Was Channel 14 TLPS at the student center operating at 100 mW? 200 mW? 500 mW? 1 W? Needless to say, the power level makes a difference. In the FCC TEC demonstration, NCTA's analysis indicates that Globalstar operated Channel 14 TLPS at 200 mW, which is significantly less than the Commission's proposed power level. [5] The separation distances between user equipment and access points are not all that meaningful if the access point power levels during the demonstration are not specified.

Similarly, Microsoft could not find references to the load factors for the access points operating on Wi-Fi Channels 1, 6, and 11, nor for TLPS operations on Channel 14 used for the compatibility demonstrations. This is significant because one might expect a different outcome if all four independent channels were operating at high-duty cycles than if each channel was operating at a low-duty cycle. And while Globalstar's filing contained references to data types, only in some instances was Microsoft able to identify which particular channels were associated with the data types during the various demonstrations. Additionally, we were not able to find the data rates for each device used in the compatibility demos. These and other unanswered questions speak to the need for Globalstar to perform controlled testing rather than just another version of the same demonstration.

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[3] *See* Fortinet Meru, *Higher Education - Intelligent campus Wi-Fi for the always-on generation,* http://www.merunetworks.com/Industries/Higher-Education.html (last viewed Sept. 30, 2015) ("Meru provides the wireless access points and controllers, along with the software tools you need, to administer the network across the university campus and satellite space.").

[4] FCC 13-213 at paragraph 28.

[5] NCTA, *Written Ex Parte Submission*, IB Docket No. 13-213 (April 16, 2015) at page 2.

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III. Demonstrations Regarding TLPS Existence Were Extremely Short

The seemingly extremely short length of the demonstrations regarding TLPS existence are yet another example of the Globalstar filing's shortcomings. Regarding the length of the demonstration, Slide 4 of the Roberson presentation, the "Summary of Deployment" slide, [6] as well as Professor Kenneth J. Zdunek's covering attestation in the section entitled, "Summary of Results of Compatibility Measurements,"[7] both speak to "extensive measurements".

Slide 15 of the Roberson presentation, "Demonstration of Channel 11 and TLPS Coexistence," describes observations of "various applications including YouTube, Skype, and Internet Explorer running on devices attached to Channel 11" with channel 14 in operation. The slide states clearly that "Demonstrations occurred on August 11 and August 18, 2015, and lasted 30-45 minutes."[8] Yet neither the slide nor any other part of the presentation indicates how much time was dedicated to each demonstration nor whether each demonstration could be repeated at least ten times in the total amount of time elapsed.

Slide 17 of the Roberson presentation, "Demonstration of Bluetooth and TLPS Coexistence," describes observation of the operation of three different Bluetooth devices in the presence of six to eight client devices each operating on Channels 1, 6, 11 and each generating continuous uplink and downlink traffic through two-way video Skype calls. The slide states clearly that "[d]emonstrations occurred on August 11 and 18, 2015, and lasted 20-30 minutes."[9] Yet again, neither the slide nor any other part of the presentation indicates how much time was dedicated to each demonstration nor whether each demonstration could be repeated at least ten times in the total amount of time elapsed. Given that slide 6 of the Roberson Presentation, "Baseline Throughput Measurements," states that "[t]hroughput on each of Channels 1, 6 and 11 is highly volatile and dependent on time of day and location of access points in the network," it is surprising and concerning that Globalstar's demonstrations of coexistence were so short.

It may be that there are explanations available since we have had difficulty reconciling the length of the demonstration of Channel 11 and TLPS coexistence in slide 15 and the length of the demonstration of Bluetooth and TLPS coexistence in slide 17, with the length of the demonstration of coexistence between technologies implied in the Summary slide 4. Further elaboration on this point would be helpful.

IV. Globalstar's Filing Did Not Address Important Use Cases Microsoft Has Identified

Another deficiency of the Globalstar filing is its failure to address important use cases Microsoft has identified. In its May 29, 2015 letter to the Commission, Microsoft identified two situations in

[6] Globalstar *Ex Parte*, *supra* note 1, at 15.
[7] *Id.* at 8.
[8] *Id.* at 26.
[9] *Id.* at 28.

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particular that must be addressed when considering terrestrial use of the 2473-2495 MHz band for low-power mobile broadband networks: (1) quality of service for real-time, two-way video communications such as Skype and Skype for Business in high-density deployments; and (2) system level testing of game consoles that rely on Bluetooth or Bluetooth like communications.[10]

As a threshold matter, we do not believe that a student center in mid-August is representative of a high-density deployment. Furthermore, we are not really sure of what to make of Globalstar's statement that "[d]uring the Skype video call demonstrations, no interruptions or degradation in quality of the video call was observed (on Channel 11),"[11] as all access points used were enterprise grade, and there is a dearth of information on the operational parameters. Also it is standard industry practice to assess the end users' perceived quality of a given network for delivering audio (and video) by calculating the Mean Opinion Score (MOS). The MOS is expressed as a single number in the range 1 to 5, where 1 is the lowest perceived audio quality and 5 is the highest perceived audio quality. These scores are created by averaging statistically valid sample of individual scores. And while the MOS is somewhat subjective, as long as the individuals have no affiliation with any of the parties, there can be some sense of the resulting audio and video quality for the demonstration parameters used. Clearly no MOS assessment was performed. How many people did determine that there was no interruption or degradation in quality of the Skype video call? Over what period of time? Were these individuals affiliated with Globalstar, Roberson & Associates, or some other interested party?

It speaks for itself that the student union demonstration did not include a demonstration with game consoles that used Bluetooth or Bluetooth-like channels, either ours or those of our competitors.

V. Proposed Network Operating Systems Will Not Protect Broad Classes of Wi-Fi Users

Globalstar's filing does not address the fact that its Network Operating System (NOS) will leave broad classes of Wi-Fi Users unprotected from harmful interference. Globalstar claims its NOS will "provide a platform for operators of licensed and unlicensed devices to quickly provide notice to Globalstar of any claimed interference to their services . . . but also will be capable of mitigating harmful interference to other licensed and unlicensed services . . . ."[12] Does this mean that Globalstar will require the operators of enterprise networks seeking protection from TLPS interference to download its network management software? Would this software be proprietary? And what happens to all other Wi-Fi users?

Globalstar claims that it is only interested in deploying TLPS for enterprise systems. While enterprise systems include standalone business campuses, they can also include college campuses, shopping centers, mixed-use development complexes, and other similar facilities where many different types of Wi-Fi access points and user equipment operate. As nothing prevents Globalstar from broadly

[10] Microsoft Corporation, *Written Ex Parte Submission*, IB Docket No. 13-213 (May 29, 2015).
[11] Globalstar *Ex Parte*, *supra* note 1, at 27.
[12] *Id.* at 1.

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deploying TLPS, the Commission should not base any rules on Globalstar's currently proposed business model.

The first order challenge is that most individuals, small businesses, and organizations whose Wi-Fi or Bluetooth devices might be impacted by a nearby TLPS deployment will have no idea what caused the degradation in service or whom to contact. Those who take action may call their cable provider, satellite provider, wireless provider (if it is Mi-Fi), or even online game provider to complain. Ultimately, all these complaints must funnel back into Globalstar and be addressed in near-real time. While Globalstar must address complaints of harmful interference from licensees, it is not clear what legal obligations it has to protect unlicensed services, as unlicensed services must accept interference.

VI. Promises Alone Not to Utilize LTE-U Hold Little Value

In its May 29th letter, Microsoft also highlighted that Globalstar could decide to use LTE-U technologies for its TLPS service. There are inherent differences between LTE-U and Wi-Fi. Globalstar says it will not deploy any LTE-U based service in unlicensed spectrum until the Commission has otherwise allowed such deployment to proceed—but Globalstar did not say it would *never* deploy LTE-U. Globalstar's commitment begs the question of whether its claims of TLPS coexistence with Wi-Fi and Bluetooth based on its demonstrations can be extrapolated to unlicensed LTE technologies, and specifically to LTE-U.

VII Conclusion

It has been almost two years since the Globalstar NPRM was adopted. In the intervening time, Globalstar could have tried to allay reasonable technical concerns expressed by a number of trade associations representing a cross section of unlicensed 2.4 GHz ISM users. Throughout this time, Globalstar has chosen not to conduct genuine testing, but instead, merely to conduct demonstrations. The Commission's technical rules are by their very nature data-driven. Data-driven approaches require analysis, modeling, and testing. The student center demonstrations that examined coexistence between TLPS and Wi-Fi and TLPS and Bluetooth fall significantly short of what is necessary to answer fundamental questions regarding such coexistence.

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Please direct any questions regarding this matter to the undersigned.

Respectfully Submitted,

/s/

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